Design With Care

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"The proper study of mankind has been said to be man. But I have argued that man - or at least the intellective component of man - may be relatively simple, that most of the complexity of his behaviour may be drawn from man's environment, from man's search for good designs. If I have made my case, then we can conclude that, in large part, the proper study of mankind is the science of design."
(Simon 1969)

Introduction:

This paper is primarily about design and some of the difficulties of 'appropriate' design in care settings: about the interaction between technologies, application domains, design methodologies and about some of the challenges of informing design. This is hardly a novel concern, but this particular focus arises as a consequence of digital technologies maturing and transferring to the everyday domain; as the convergence of interactive digital systems, networks and mobile devices potentially transforms the ways that we carry out mundane, everyday activities. In recent years, the increasing presence of computing technology in the domestic environment has emerged as an important new arena of study (Kidd et al 1999). Domestic environments are becoming key sites for the consumption of information and communication technologies - embracing, in the 'care' domain, various forms of 'assistive' technologies and the design and provision of 'smart' homes. This paper reports on a recently initiated research project – 'Care in the Digital Community' - begun under the EPSRC IRC Network project EQUATOR (http://www.equator.ac.uk/). The project aims to use a multidisciplinary research team to facilitate the development of enabling technologies to assist care in the community for particular user groups with different support needs. The general objective is to examine how digital technology can be used to support sheltered housing residents and their staff. Although only recently started, the project anticipates exploring the affordances of a variety of technological configurations, including the use of virtual environments replicating real world situations, and the use of handheld and wearable digital technology to provide support.

Design and Methodological Challenges

Much of the work in the care domain has been technology rather than 'needs' led - indeed gaining a comprehensive understanding of needs or a perspicuous view on user requirements in this domain poses a number of interesting methodological challenges. It is not just that many of the important ethical and deployment issues concerning the development and evaluation of real systems remain unexplored, but that methods for eliciting needs in such a complex setting are relatively under-developed. The extent to which the relatively well tried and tested ideas and methods used to understand work environments can be transposed to investigation of domestic environments is an open question. Domestic environments in general -- and 'care' settings in particular -- are

very different spaces from working environments and represent a very different set of challenges for those involved in the design of systems. This paper therefore considers some of the implications of the methodological options open to those working in the domestic domain, in particular, the translation of research into design recommendations and the attempt to uncover, elicit or validate 'requirements'. Moving away from technology led applications and attempting to have a useful input into the development process requires an understanding of how technologies and their uses are integrated in a range of social contexts. The problem is that research in certain contexts is often regarded as difficult, if not inappropriate. The deeply personal nature of many social activities limits just what can be investigated and reporting the interactional elements in a range of activities and contexts is difficult. Ethnographic studies (Hughes et al 1994) claim to provide a 'sensitising' to the 'real world', 'real time' character and context of everyday life and the facilitation of what Anderson (1994) calls "the play of possibilities for design". Much of our understanding of designing computer systems has been the product of ethnographic investigation of the workplace and we require significant shifts in our investigative techniques, as well as in our understanding of design, to consider how technology relates to and supports everyday living rather than productivity.

These and other delicate issues represent potentially obdurate problems and methodological responses have taken a number of forms. At present, the project research method for technology development includes ethnographic study, user-centred design and evaluation and the use of 'cultural probes'. Cultural Probes (Gaver et al 1999), originating in the traditions of artist–designers rather than science and engineering, are a way of supplementing ethnographic investigations, prompting responses to users' emotional, aesthetic, and social values and habits, as well as providing an engaging and effective way to open a dialogue with users.

"Thus we were after "inspirational data" with the probes, to stimulate our imaginations rather than define a set of problems. We weren't trying to reach an objective view of … needs through the probes, but instead a more impressionistic account of their beliefs and desires, their aesthetic preferences and cultural concerns." (Gaver et al 1999)

Our use of cultural probes currently involves the distribution of cameras, dictaphones, postcards, maps and notepads to staff and residents in a semi-independent living environment in order to acquire both information and inspiration for the design of assistive technologies. The eclectic approach adopted by this project attempts to meet some of the ethical and moral dilemmas through careful involvement and acknowledgement of users in the design process. 'Process' here encapsulates rather more than the requirements elicitation stage to include deployment, use and evaluation. It therefore incorporates possibilities for 'innofusion' (Fleck 1988; Williams et al 2000) (where getting devices to work in particular user settings produces useful innovations) and 'domestication' (Williams et al 2000) (the integration of a device into everyday practice). In amongst the technical challenges, central to the project and the technology development effort are issues concerning generalisability, the transfer of skills to real world situations, and support for independent living in the community. This challenge highlights some of the moral and ethical components of the design enterprise, in particular the need to carefully think through and balance issues of 'empowerment' and 'dependence'. The design challenge is to provide support for individuals in the move towards independent living, rather than create new, technological, forms of dependence. It involves an

ethical awareness and recognition of the way that technology can impinge on individual care pathways, and a sensitivity towards the implications of any such intervention. It further involves a recognition and understanding that the project, and any associated technical development, takes place within a particular political and moral framework (of deinstitutionalisation), and inevitably becomes embroiled in the various social science debates that surround this issue (Eyles 1988; Dear and Wolch 1987; Martin 1984). Of particular relevance is Gleeson and Kearns' (2001) comment that; "De-institutionalisation has been constituted through moral-ethical discourses about places, about good and bad places - about moral landscapes". The challenge for design in these settings, therefore, is not just to recognise this dilemma, but to steer a careful path through this moral landscape. Embodying a philosophy of care into design necessitates considering issues of empowerment and dependence and then thinking how these might usefully become incorporated into design guidelines.

Background and Setting: Hostel and Semi-independent living

The setting for the project is a hostel and nearby and associated semi-independent living accommodation (see Figure 1 below), managed by a charitable trust, for former psychiatric patients in a large Northern town. The hostel is the first step for patients leaving the psychiatric wards of local hospitals the hospital environment. Here they are provided with a room and are monitored and helped to develop independent living skills by a number of staff. Residents can then move on to the other, semi-independent living site, which is sheltered housing consisting of a number of flats and bed-sits, prior to moving out to flats in the local area, or, if they are deemed to need further and continuing support, back to the hostel. The overall aim of these facilities is to gradually introduce the patients back into the community and allow them to support themselves. Emphasis is on the learning of daily living routine and skills and any technology introduced should contribute to this goal. A technology that merely completes a task for residents does little in producing independence but merely shifts reliance onto the technology.

Figure 1: The hostel.

Supporting Various Forms of Awareness: Security and Medication

Although our research is at an early stage, a number of issues/requirements have already arisen. Initial introductory and debriefing meetings at the hostel and the semi-independent living accommodation, and the early ethnographic fieldwork currently

indicate some major preoccupations of both residents and care workers - all of which centre on supporting various forms of ‘awareness’.

Firstly, there is an absolutely overwhelming preoccupation with security. Situated on what is acknowledged to be a ‘difficult’ council housing estate, both residents and staff have been subjected to frequent physical and verbal attacks. A number of meetings to address this issue have been held with the local community and the police and four CCTV cameras and nine foot iron railings have been installed to protect the semi-independent living accommodation. The house is also protected by burglar alarms and an entry control system. Paradoxically, these now mark out the residents as being somehow ‘different’ and make them the natural and unfortunate victims of ill-informed, media induced, moral panics about ‘paedophiles’ or ‘community care’. Attacks and verbal abuse by children has resulted in the gates being locked at four o’clock each day and some residents will only travel outside the accommodation by taxi and residents are increasingly cut-off from the outside community.

The main locations for the attacks are the road between the hostel and the semi-independent living accommodation and the park next to the accommodation which is used either as the quickest way into town or to avoid the abuse and attacks associated with the other route (see Figure 2 below). In these circumstances, a security/monitoring system that would allow staff to monitor residents travelling between sites in order to increase the sense of safety, reduce anxiety and reassure residents. Such a system may also contribute to greater community awareness amongst both residents and staff.

Figure 2: The road between the hostel and the semi-independent living accommodation (left), and the neighbouring park (right).

In order to encourage residents to feel safer while traveling between sites we are investigating the potential for issuing personal panic alarms. When activated, such alarms would alert staff as to the identity and location of the person in distress. The alarm needs to be lightweight (possibly wearable) and should not have any significant commercial value because of fears of encouraging theft and possible assaults. In addition, the device needs to be highly dependable both in terms of location accuracy

and the ability to communicate the distress call in a timely manner. In order to respect residents' rights to privacy, their location will not be tracked constantly, instead their location will only be communicated when the alarm is activated. In terms of location sensing, one approach that might be suitable in the future would be to use a system such as E-OTD (Enhanced Observed Time Difference location technology) (see http://press.nokia.com/PR/200102/809551_5.html). However, this solution is not currently viable because the modifications required to the base station infrastructure are not yet in place. The approach that we are currently considering is to deploy a device that incorporates a GPS (global positioning system) receiver and transmits the user's current coordinates via a GSM (global services mobile) connection whenever the alarm button is pressed.

The GPS system is based on a collection of 24 satellites that orbit the earth. These satellites transmit signals that can be received by special purpose GPS receivers. If a GPS receiver is able to receive the signal from three or four satellites (see figure 3a) then it is able to calculate its geographic position (to an accuracy of approximately 10 metres) by using highly accurate timing information which is coded into the signals transmitted by the satellites (see figure 3b). In order to receive the signal from a satellite, the receiver must have visual contact with the satellite and this can make operation in high-rise city environments problematic.

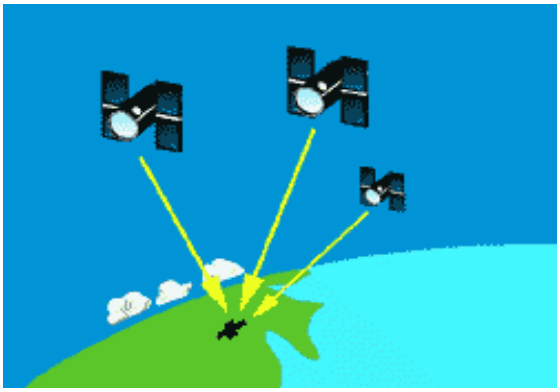

Figure 3.a

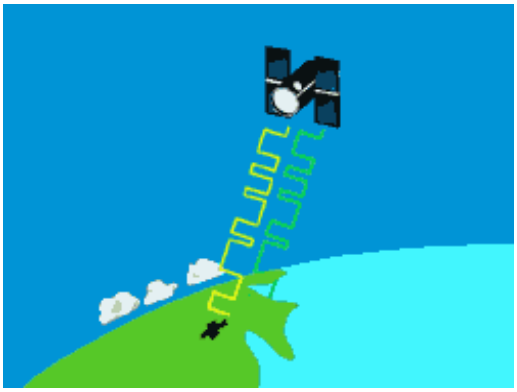

Figure 3.b

We had considered using SMS (simple messaging service) as the transport for sending the GPS information, however, we discounted this approach because of its lack of dependability. In more detail, SMS traffic is only sent when the network is under a low loading and so, if the GSM network happened to be under a high loading at the time then the successful transmission of the panic call could be delayed by a significant, and potentially critical, period of time.

One of the most significant benefits of the proposed panic alarm device is that it need not be incorporated into a mobile phone and consequently is less likely to be perceived as worth stealing. The potential drawback of this device is that in certain areas of the town the so called 'canyon effect' could prevent a GPS fix from being obtained. However, tests in the area between the two sites revealed that the view of satellites by the GPS receiver is very good. However, if residents did wander into an area where a GPS fix could not be obtained then this would clearly present a real problem. For these reasons, we are designing the unit in order to provide its user with

simple but immediate feedback if there is any problem with obtaining a location fix and/or communicating the distress call.

A second concern of both residents and staff focuses on issues surrounding the routine taking of daily medication. At the initial project meetings a number of residents expressed their concerns about the possible consequences of them forgetting to take their medication. In both informal interviews and via the postcards issued as part of the cultural probes residents expressed an almost overwhelming interest and concern with issues of medication, its importance, availability and effectiveness. Medication issues - dosage, delivery of 'medi-pacs', reminders, re-assuring residents about delivery and so on also feature heavily in the everyday work of the staff. At the hostel medication is kept in a locked drug cabinet, distributed by the staff when required with records kept in a written log. At the semi-independent living site patients must manage their own medication and it is a source of continuing anxiety for the residents. Although provided with a week's supply of packaged daily doses by the pharmacy - medi-pacs - there is some concern that they may either forget to take their medication or accidentally overdose. Technical devices that may prove useful in these circumstances are various medication reminders that help patients manage their own medication, i.e., when to take it, record acknowledgements of reminders, and so on, allied with a system to automate the recording of drug information. The functionality of any technology provided must be carefully considered and sensitively deployed. The devices are intended to act as 'reminders' to residents to take their medication and are not indicators that any medication has been taken. Obviously such devices must be dependable as failure of the technology could have potentially disastrous consequences.

Where residents are responsible for taking their own medication, this fact has significant implications for the way in which medication is monitored and tracked. For example, the use of a bar-code scanning approach would place an inappropriate burden on the resident. One possible approach is to use RFID-based smart labels in order to ascertain whether a resident has taken their medication from the medication store - as used in the 'Magic Medicine Cabinet' (Dadong 1999) system. Another possibility worth exploring is to build certain reminder and recording features into the medi-pacs themselves. Again, this will not control the medication regime to prevent deliberate overdosing, but it may contribute to the prevention of accidental overdosing. Some instances from the early fieldwork - coincidentally occurring on the same day - illustrate this point. In one case the care worker, following a phone call from the resident's doctor, was concerned to intercept the delivery of a medi-pac in order to replace one dosage of tablets with another. In another incident there was some concern that an elderly resident was accidentally overdosing as a consequence of the design and delivery system for the medi-pacs. As the medi-pacs are delivered from the pharmacy at about 6:30pm, the resident was required to take only the evening dose for that day, leaving the two earlier doses to be taken the next week. Problems were arising both because the resident, used to emptying each daily dose, was accidentally overdosing by taking all the medication for the delivery day, but also was being left with no morning or afternoon medication for the same day on the following week.

The medi-pac used by the residents at the semi-independent living hostel is a blue vinyl folder with seven plastic containers, each with four compartments. Each

container is used to hold a day's medication and the whole pack is issued to the residents every week with medication for the next seven days. Our interest is in how to augment the medi-pac in order to aid the residents' management of their medication. Any device must help the residents manage their own medication rather than managing it for them. The main problem is establishing the dosage and timing of any medication. Such a device may also offer a level of reassurance to residents, by providing indications that they are following their medication regime correctly. As the residents rarely carry the containers or pack with them, and are rarely away from the site for lengthy periods of time, the device is not required to be mobile, and any device constructed can be installed in a resident's flat. Size of the device is therefore not a constraint. However, the device must hold a week's supply of drugs and it would be useful to make it simple to restock. Within these constraints, a prototype device is currently under discussion. This would consist of a 'lightbox' frame, into which a transparent box with internal compartments could be placed. The base of the frame would contain LEDs (light emitting diodes) to indicate the correct dosage for the time of day. It may also be useful to construct the frame with sensors to that would allow the controlling software to monitor when a dose has been removed.

One final issue about control of medication arose when one of the residents deliberately overdosed by taking all the medication in the newly delivered medi-pac. This incident highlighted other issues to do with medication and the recording of, access to and integration of information, as the care worker sought to give information on the resident and the medication regime to the ambulance service. Such information has four possible locations, a whiteboard that has details of each resident, their key worker, consultant, social worker and community psychiatric nurse; a noticeboard that details who is living in each flat or bedsit; the computer and the filing cabinet that contains the resident's records (see Figure 4 below). Ways of integrating, up-dating and displaying this information are currently being investigated.

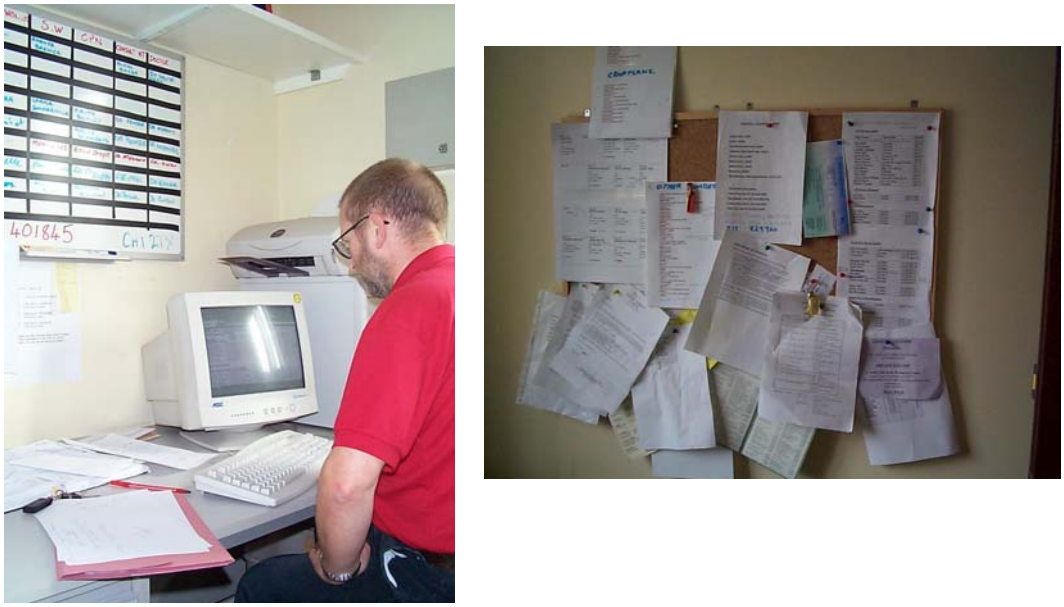

Figure 4: Locations of resident information. The computer and whiteboard (left) and the noticeboard (right).

Summary and Concluding Remarks

The main aim of our project is to explore the extent to which the requirements of a community care trust can be met by technology whilst staying within the political and ethical boundaries imposed by this setting. This paper has sought to identify and address some of the complex design challenges faced when trying to investigate, understand and then meet the requirements of the 'real life, real time' concerns of this complex application domain. With regard to the first of these concerns, we can report some measure of success in the use of cultural probes as a means of going beyond the limitations of ethnographic investigations. The extent to which we have then translated the results that these investigative devices have delivered into useful technological interventions will be tested over the coming months, when we begin deploying the chosen solutions within the trust itself.

This deployment process will itself raise a whole series of important and necessary issues including tailorability, mobility, and the trade-off between generic and specific devices. Following deployment, a period of evaluation will commence which (in addition to raising further issues) will no doubt lead to refinements in our initial set of requirements and therefore modifications to our adopted approach as an aspect of cooperative design; "an approach to the creation of more useful and useable computer artifacts ... the combination of envisioning, building and use ... as we work our way through successive rounds of trial and discovery regarding all of the ways in which the world is different than we had imagined it to be." (Trigg et al 1999)
Users need the opportunity to explore fully the possibilities for adopting, and adapting to the new technologies. As assistive technologies are developed and penetrate more and more into this domain, the real problem becomes not so much the creation of devices as their effective integration with the everyday demands of the particular setting and what Henderson and Kyng (1991) refer to as 'design in use' becomes achievable.

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